The Early History of Chance in Evolution: Causal and Statistical in the 1890s

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Of all the shifts that took place in the early development of evolutionary theory between Darwin's publication of *On the Origin of Species* in 1859 and the New Synthesis of the 1940s, two in particular stand out for those interested in the role of chance in evolutionary theory. Darwin's own evolutionary theory is, by and large, non-statistical and describes nonchancy processes in the world. By the New Synthesis, as the standard story goes, we have a fully statistical population biology, as a theory of processes in nature which are, to some extent, intrinsically chancy. Thus there are two shifts here: one from a non-statistical to a statistical theory, and one from a conception of the process of evolution as fundamentally non-chancy to fundamentally chancy.

How did these two changes come about? First, the move to statistics came quickly - it can be located, it is generally accepted, with Francis Galton, including his work on things like the Law of Ancestral Heredity (see Hacking's Taming of Chance, 1990).

What about the shift to "chance" in the evolutionary process? This is less clear - not least because what exactly we mean by "chance" in the evolutionary process is a highly fraught question. The most sustained attempt at providing a historical answer to this question is that of Depew and Weber (Darwinism Evolving, 1995). They argue that it is the dispute between Fisher and Wright which first makes room for a genuine sort of chance in the evolutionary process. While Fisher saw chance as merely a source of mathematical noise, and a difficulty in theorizing which needed to be overcome and factored out, it was Wright who first argued that evolution could be phrased as a theory of genuinely chancy processes - including random drift, which occasionally pushed organisms down an adaptive peak, enabling them to reach a higher neighboring optimum. On this view, we have a shift toward "chance" precisely because chance is, for the first time, an active force which can be responsible for certain sorts of population change (namely, change which runs contrary to fitness gradients).

I wish here to reevaluate this standard history, both on its own merits and in light of con- temporary philosophical practice. While I agree that Galton is the first to think of evolutionary theory in a statistical manner, I argue that a shift in thinking about the processes underlying this statistics can be detected as early as the late 1890s, in the work of Galton's students Karl Pearson and W.F.R.Weldon.

A more mathematical, more positivist school of thought, with Pearson at its head, takes these statistics to be a tool for glossing over the (complex, indifferently deterministic or indeterministic) causal details of biological systems. On the other hand, a more empiricist, experimentally inclined school of thought, led by Weldon, takes these statistics to be an essential way of grasping the full causal detail of biological systems.

Importantly, the sense of "chance" implicated in this shift is not one from merely subjective, Darwinian chance-as-ignorance to a reified, objective, Wrightian notion of genetic drift. This implies that we are looking for some kind of "ontic" notion of chance - when did these scientists first believe that chance was "really out there" in the world? I argue that the interesting transformation does not lie here. Rather, if we focus on the relationship between the statistical vocabulary of these theories and the processes that the theories aim to describe, we see much more rapid and important developments throughout the period just following Darwin's death. Further, this question - unlike the "ontic" notion of chance - forms

an relatively continuous research question from the late 1890s to the contemporary debate between "causalist" and "statisticalist" interpretations of natural selection and genetic drift in current philosophy of biology. Weldon, on this view, looks much like a "causalist" against Pearson's "statisticalist" interpretation.

We cannot see in Weldon's work anything like a complex notion of probabilistic causation or probabilistic views of organismic fitness. But we can see, I claim, a dramatic shift in the understanding of the connection between evolutionary theory and the evolutionary process, a shift that is best understood not by way of the "reificaiton" of chance, but by asking about the relationship between biological statistics and biological processes - a question that is simultaneously more contemporarily relevant and more historically informed than the current landscape of the debate.